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ABSTRACT

Reported are the results of a workshop designed to instruct college teachers and science consultants in "Science - A Process Approach" and "Science Curriculum" "Improvement Study" curricula. One of the objectives of the workshop was to influence participants to promote these curricula and initiate change. This report is an evaluation of the reactions of participants to the workshop and their behavioral change after they left the workshop. Pre-workshop, post-workshop, and follow-up measures indicated that significant differences in knowledge of the two programs, knowledge of process skills, knowledge of change-agent skills, and in attitude toward the two elementary science curricula were developed. Increased inservice activities and an altering of preservice courses to include more of the AAAS and SCIS philosophies and activities were among the changes reported. (BR)

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A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE: AN IN-DEPTH EVALUATION

Dale G. Merkle
Department of Elementary Education
Shippensburg State College
Shippensburg, Pennsylvania
17257

(From a study done at Michigan State University under the guidance of Dr. T. Wayne Taylor, with the cooperation of the National Science Foundation Workshop director, Dr. Richard J McLeod)

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A LEADERSHIP WORKSHOP ON ELEMENTARY SCHOOL SCIENCE: AN IN-DEPTH EVALUATION

Introduction

There is a need to study summer institutes to determine what takes place in the institutes and how these activities relate to subsequent changes in the behavior of the institute members. Also, there is an urgent need to follow up participants of institute programs to determine the effectiveness of the programs in which they have engaged.

It was proposed that this type of evaluation be conducted with participants from the Leadership Workshop on Elementary School Science which was held at Michigan State University during the summer of 1968.

The Workshop was designed to prepare the participants to help schools implement two of the new elementary science curricula. They are Science--A Process Approach developed by the American Association for the Advancement of Science (AAAS) and the Science Curriculum Improvement Study (SCIS).

This Workshop was aimed at the need for a fairly rapid re-training of large numbers of in-service elementary school teachers to make effective use of the new curricular materials. At the same time, this Workshop for college teachers sought to produce changes in the

pre-service preparation of elementary teachers to include the content and teaching modes recommended for the new materials so as to reduce or eliminate, if possible, the need for retraining.

This Workshop was unique and lent itself to the evaluation proposed since it included as its objectives: (1) providing the participants with considerable knowledge of the purposes, history, recommended modes of teaching, objectives, materials, and teacher education procedures of the Science Curriculum Improvement Study and of Science--A Process Approach; (2) providing opportunities for the participants to teach science to children using the new curriculum materials and to provide the participants with feedback on their teaching; (3) engaging the participants in giving feedback to elementary classroom teachers whom they have observed teaching children with the new curriculum materials; (4) familiarizing the participants with the school settings and with the administrative aspects of implementation; (5) assisting the participants as a group and as individuals to plan and to prepare appropriate materials and activities for orientation sessions and in-service programs; (6) providing experience in organizing and presenting orientation sessions on the programs to groups of school teachers and administrators; and (7) that the participants would be engaging in change-agent activities after they left the Workshop; i.e., put what was learned into practice.

It was also unique in that experiences in group-process skills and change-agent strategies were an integral part of the

program in addition to the training in the philosophies, processes, concepts, and materials of the AAAS and SCIS programs. The participants, as part of the Workshop activities, also prepared and gave a three day workshop for elementary school teachers and administrators. This three day participant-directed workshop served as an initial contact with elementary school personnel selected from the geographic area of the participant's institution. The three day workshop was meant to establish an awareness in the surrounding communities concerning the new science programs and the availability of consultants. The participants were prepared to engage in a large scale implementation project* to develop a network model involving college or resource teachers (T_3's), experienced in-service pilot teachers (T_2's), and pilot teachers (T_1's). (This model is often referred to as TTT or T^3 program.)

The major thrust of this Workshop was toward the preparation of the participants to accept active roles as resource trainers in the implementation model.

Assumptions

This study was designed to gather evidence to determine whether or not such workshops are worth repeating; and, if so, how

*A Research Proposal submitted by Dr. J. R. Brandou, chairman of the Science and Mathematics Teaching Center at Michigan State University, to the National Science Foundation on December 19, 1967.

they should be modified in order to be more effective.

It was assumed that the Workshop could make a contribution to the educational community and was worthy, therefore, of study. It was further assumed that the elementary science curricula which were studied are viable representatives of modern science education. Also, it was assumed that the instruments utilized in the study were suitable. All instruments used in the study were prepared by the staff of Michigan State University.

Finally, it was assumed that there exists a wider population of college teachers and resource persons described by the participant description herein.[1]

Objectives of study

The principal focus of the study was concerned with the following items.

1. To report the content, methods, and procedures of the Workshop.
2. To report the participants' evaluation of their perceived needs and how the Workshop met these needs.
3. To describe the changes in knowledge of and attitude toward AAAS and SCIS elementary school science curricula as measured on pre, post, and mid-winter evaluations.
4. To describe the effects of various aspects of the Workshop activities on the attitudes of the participants.

The activities considered are:

A. Orientation to programs

B. Laboratory and micro-teaching involvment using AAAS and SCIS materials

C. Group-process skills

D. Change-agent skills

E. Three-day workshops conducted by the college teachers (T_3) for elementary school teachers (T_1) and administrators.

5. To describe the relationships that exist between attitude towards the SCIS and AAAS programs and attitudes towards the various aspects of Workshop activities as mentioned in objective number 4.

6. To describe the relationships that exist between knowledge of the program characteristics and their implementation procedures, and the attitude toward various aspects of Workshop activities as mentioned in objective number 4.

7. To describe the relationships that exist in attitude and knowledge between Workshop measures and Mid-winter Conference measures.

8. To describe the behavioral changes of the participants in their on-the-job implementation of curriculum change in activities related to the two programs studied in detail at the Leadership Workshop.

9. To make recommendations for future workshop evaluations.

Participant description

Participants for the College Teacher Workshop were invited from the population of college and university professors currently teaching science and/or science education courses for pre-service elementary school teachers and from elementary science consultants and science supervisors. Selection preference was given to applicants from the State of Michigan. Also, since it was expected (and proved to be so) that participants would receive requests for consultation services from local schools, selection preference was given to participants who were in a position to influence science education and who provided evidence, in writing, that their administration would permit them to engage in consulting and implementation activities.

Description of evaluation methodology

The study of the College Teacher Workshop at Michigan State University was conducted in two phases as seen in Figure 1.

July 29 thru August 23	December
-Workshop-	-Mid-winter Conference-
PHASE I	PHASE II

Figure 1.

Phase I was an evaluation of the first objective as measured by the learning experiences of the participants during the

actual Workshop. Phase II was the evaluation made at the Mid-winter Conference.

Figure 2 shows in detail the areas evaluated in each phase.

Figure 3 indicates the test schedule.

Areas of Evaluation

PHASE I	PHASE II
A. Changes in:	A. Measures of:
Knowledge of program characteristics and program implementation procedures. (Instrument A)	Knowledge of program characteristics and program implementation procedures. (Instrument A)
Attitude toward programs and their content. (Instrument B)	Attitude toward programs and their content. (Instrument B)
Analysis of personal behavior in groups. (Instrument C)	
Knowledge of change-agent strategies. (Instrument D)	
B. Satisfaction of perceived needs. (Instrument E)	B. Satisfaction of perceived needs. (Instrument E)
	C. Behavioral change in participants. (Instrument G)

Figure 2.

----------PHASE I ----------			PHASE II
Pre-institute test over areas outlined in Figure 2.	Attitude change evaluations corresponding to major change in the emphasis of the Institute.	Post-institute test over areas outlined in Figure 2.	Mid-winter test over areas outlined in Figure 2.

Figure 3.

Description of measures

All measures and questionnaires used in this study were created by staff of Michigan State University.

Instrument A, Knowledge of Program Characteristics and Program Implementation Procedures, is a measure of Workshop content. This fifty-seven item, multiple-choice instrument assesses knowledge of the AAAS and SCIS programs and was constructed to reflect the objectives and operations of the College Teacher Workshop.

Instrument B, Attitude towards the AAAS and SCIS Programs and the Content of These Programs, was designed to measure attitude changes due to Workshop activities and content. The seven levels of response, from very strongly disagree to very strongly agree, were weighted one (1) to seven (7). Sixteen of the eighteen items were scored as described above. The last two items, number 17 (Which program do you prefer?) and 18 (Give two reasons why?) were not scored as such, only noted and mentioned as individual responses.

Instrument C, Analysis of Personal Behavior in Groups, was administered only as a pre and post summer Workshop measure. The

rankings were weighted one (low) to seven (high). The purpose of this measure was to obtain some idea of the effectiveness of the group process sessions in creating an awareness of and gains in personal/group behaviors.

Instrument D, Knowledge of Change-Agent Strategies, was designed to determine if the participants gained significantly during the Workshop in the area of change-agent skills.

Instrument E, Satisfaction of Perceived Needs, was designed by Workshop staff to determine the areas of need, and to measure how well the Workshop satisfied these needs. A variety of topics concerning the new science curricula and school community expectation of the participant were scored on a weighted basis, from very low (1) to very high (5).

Instrument F, Evaluation of the Divisions of the Workshop, was given as a post-Workshop and Mid-winter Conference measure. This instrument was used to determine the attitudes of the participants toward the various divisions of the Workshop. The four-week College Teacher Workshop was arbitrarily divided into five divisions. They are:

1. Orientation to AAAS and SCIS
2. Laboratory and micro-teaching activities using AAAS and SCIS materials
3. Group process skills
4. Change Agent skills
5. Three-day Elementary Teacher Workshop conducted by participants.

Their opinions on statements as they pertained to each division were recorded on a weighted rank scale. The range of responses was from very strongly disagree (1) to very strongly agree (7).

Instrument G evaluated the behavioral change of participants. A behavioral change of a participant is defined as a change in pre-service or in-service procedures resulting from participation in the Workshop and communicating the instructional intent of the Workshop.

This study would seem closely related to others if it were not for the unique format of the Workshop. This Institute included, within the duration of the Workshop: (1) providing the participants with considerable knowledge of the AAAS and SCIS programs, (2) opportunities to use AAAS and SCIS materials with elementary children, (3) a three-day workshop, designed by the participants, that provided an initial contact with elementary school science teachers, and (4) instruction in group-process skills and change-agent skills to assist the participants in their implementation efforts. The follow-up of participants to see if what was learned at the Workshop was put into practice is not only unique but essential to a total evaluation of the Workshop.

Research findings

Events of the Workshop

All of the Workshop activities were held at Michigan State

University except for the three-day, participant-run workshop. Much of the first and last days of the four-week workshop were devoted to testing and evaluation of the participants in order to assess their gains in the Workshop.

July 29 - August 2

The first week of the program was devoted to an introduction to the use of group process skills, and to introductions to the two curricular programs selected. On July 30 and 31, a writer for the AAAS program worked with the teachers on typical activities of Science--A Process Approach, its philosophy, objectives, and some of the materials. He also conducted a demonstration class using children for the group to observe and critique. On August 1st, the group had their first micro-teaching experience with children, using Science--A Process Approach materials. Later in the day, they were introduced to implementation activities and workshop design. A teacher with the SCIS program and the Director of the SCIS Trial Center at Michigan State University then worked with the group on August 2nd on the philosophy, materials, recommended modes of teaching, and objectives of the Science Curriculum Improvement Study Program. The SCIS teacher taught a demonstrations class for the group with children using the SCIS materials.

August 5 - August 9

By the second week of the program, the participants had

used both SCIS and AAAS materials with children, and had watched experienced teachers teach children using those materials. They also had experienced first hand involvement with the materials. At this time, group process skills were again introduced to the group. In particular, they observed teachers, who were inexperienced with the SCIS materials, in inquiry lab situations. They interacted with these teachers, and were later given feedback on the results of their interaction as viewed by the teachers.

A representative of the SCIS program and a representative of the AAAS Science--A Process Approach program worked with the group on August 7-9. The first day, each made a half-day presentation on the teacher education programs of their particular curricular project. This was done before the entire group. At that time, the group divided in half so that each half could conduct a more intensive study of one of the programs. It is important to recognize that, at this point, each of the participants had more than a superficial look at both programs and could probably be expected, with little extra effort, to help teachers in either program. One objective of this workshop was to prepare people who were very competent in one of the programs, but knowledgeable in both to some degree. For the next three days, each group worked with their respective consultants on the kind of workshop activities appropriate for teachers and the design of a three-day awareness type workshop.

August 12 - August 16

During the third week, three and four man teams were formed to design a workshop plan for the orientation conference that was to be held for school personnel during the fourth week of the leadership workshop. During this planning week, a major effort was made by the group process people to help the teams to work more closely together in developing the best possible workshop plans. Each team developed its own workshop with assistance and guidance from the staff to the extent help was desired. Presentations on change-agent skills were also made during this week.

August 19 - August 23

Early in the last week of the workshop the teams gathered their materials and moved as a group to the Michigan Education Association Camp in Battle Creek, Michigan. Those attending were divided into nine groups by geographic areas and the teams of college teachers were then responsible for a group for the entire three days. Where possible, the teacher groups were directed by college workshop participants from the same geographic area.

When they returned to the campus, the remaining materials were distributed to the participants so that they would have materials with which to work when they returned to their respective campuses. Evaluation of the total workshop and of the participants' growth proceeded through Friday.

Mid-Winter Conference

On December 12, 13, and 14, twenty-eight (28) of the college teachers returned to the campus for a mid-winter evaluation conference. Through group and individual interaction sessions the staff searched for ways to better meet the needs of the schools.

Since the close of the Summer College Teacher Workshop, newsletters have been sent to all of the Michigan school districts in an attempt to make them aware that in-service leadership and consultant services are available from these participants.

The three-day workshop at the M.E.A. Camp was considered by the participants to be the most important component of the total Workshop.

Tests of hypotheses

The first four hypotheses were analyzed using the paired t-test. Each participant was matched with himself using his pretest and posttest scores as the pair.

In the analysis for this study it was assumed that the sample size was large enough that the normal approximations are sufficiently accurate.[2] The t-test is relatively powerful for a population of thirty subjects at the 0.05 level of significance.

The one-tailed test was utilized for these hypotheses since it was assumed that the Workshop was of worth to the participants. No difference scores and a lessening of test scores were

both considered to be unacceptable if the Workshop was to have met the objectives for which it was established.

Whether or not there exists a significant positive correlation between different sets of data is tested in the last four hypotheses. The Pearson product-moment correlation provides a precise estimate of the degree of relationship in the data. A test of each correlation was made using the F test.

The discussion of the results of testing is organized according to the hypotheses.

Hypothesis 1: There will be a significant increase in knowledge of program characteristics and program implementation procedures from pretest to posttest by the participants of the Workshop as measured on Instrument A.

The hypothesis tested was: H_0: $\mu_1 \leq \mu_2$

Stated symbolically the hypothesis of interest was:

H_1 : $\mu_1 > \mu_2$

Data analysis gave a t-value for this test of 4.54. This indicates that there was a significant difference between pretest scores and posttest scores on Instrument A.

There was also a significant difference between the pretest scores of the Workshop and the Mid-winter Conference scores. Analysis of these scores gave a t-value for these scores of 4.34.

Hypothesis 2: There will be a significant positive change in attitude toward the programs (SCIS and AAAS) of the Workshop from pretest to posttest as measured on Instrument B.

Stated symbolically the hypothesis of interest is:

$$H_1 : \mu_1 > \mu_2$$

Analysis of Instrument B scores gave a paired t-test value of 3.05 for this hypothesis test, high enough to reject the null hypothesis. This rejection may lead to the conclusion that there was a positive change in attitude toward the programs during the Workshop.

Hypothesis 3: There will be a significant positive change in the analysis scores of group-process skills from pretest to posttest by the participants of the Workshop as measured on Instrument C.

Stated symbolically the hypothesis of interest is:

$$H_1 : \mu_1 > \mu_2$$

The calculated t-value is 6.54. This value is greater than the table value of 1.70 for testing significance.

The conclusion, therefore, is to reject the hypothesis of no difference in the scores on group-process skills as indicated by the participants' reactions recorded on Instrument C.

Hypothesis 4: There will be a significant increase in knowledge of change-agent skills from pretest to posttest by the participants of the Workshop as measured on Instrument D.

The null hypothesis is : $H_0 : \mu_1 \leq \mu_2$

The directional hypothesis stated symbolically is:

$$H_1 : \mu_1 > \mu_2$$

Using 28 degrees of freedom and a significance level of 0.05, a value greater than the table value of 1.70 would indicate a significant increase on this measure. The value for the paired t-test using participant scores was calculated to be 2.93.

The null hypothesis, H_0, is rejected. The possibility exists that a significant increase in change-agent skills knowledge is indicated by the participants' scores on this measure.

Hypothesis 5: There will be a significant positive correlation between the participants' scores on their attitude toward the various aspects of the Workshop activities as measured on Instrument F and the participants' knowledge of program characteristics and program implementation procedures as measured on Instrument A. The correlations will be made with measures taken both at the close of the Workshop and at the Mid-winter Conference.

The null hypothesis, H_0, is: $\rho = 0$ (no linear relationship)

H_1 : H_0 is false (there is a linear relationship between the two measures)

A Pearson product-moment correlation coefficient of 0.09 for the post-Workshop scores was found. The relationship between these measures was not significant. The F-test further concluded this by showing a value of 0.83, well below the necessary value of 4.20 for significance.

On comparison of the Mid-winter Conference scores, calculations gave a correlation coefficient of 0.17. This value indicates that there was no significant correlation of these two measures. The F-test supported this conclusion by giving for this data a value of 0.94. This is below the necessary significance level of 4.20 given in the tables.

Hypothesis 6: There will be a significant positive correlation between the participants' scores on their attitude toward various aspects of the Workshop as measured on Instrument F and the participants' attitude toward the SCIS and AAAS programs as measured on Instrument B.

The correlations were made with measures taken both at the close of the Workshop and at the Mid-winter Conference.

A correlation value of 0.36 between the Instrument B

and Instrument F was reported for measures taken at the close of the Workshop. The F value for these data is 3.83, slightly below the necessary value for significance of 4.20. While this correlation is not significant at the 0.05 level, it is significant at the 0.06 level.

For the Mid-winter Conference tests a correlation coefficient of 0.22 is reported. This is a small relationship. The F-test for these data was 1.34, considerably under the 4.20 table value for this level. The H_0 of no significant relationship cannot be rejected.

Hypothesis 7: There will be a significant positive correlation between the increase in knowledge of program characteristics and program implementation procedures as measured on Instrument A from pretest to posttest and change in attitude towards AAAS and SCIS programs as measured on Instrument B from pretest to posttest.

The Pearson product-moment correlation coefficient calculated for these difference scores is 0.36. This value is not significant and was confirmed by the F-test value of 3.85, slightly below the necessary value of 4.20 at the 0.05 level. This correlation coefficient is, however, significant at the 0.06 level.

Hypothesis 8: There will be a significant positive correlation between the satisfaction of perceived needs of the participants as measured on Instrument E and their attitude toward AAAS and SCIS programs as measured on Instrument B and utilizing:

A. the difference between Workshop pretest and end-of-Workshop posttest on Instrument B versus the posttest of Instrument E.

B. the Workshop posttests given in August

C. the Mid-winter Conference posttests

Analysis gave a correlation coefficient for the first comparison (A) of 0.26. This is not a significant relationship and is confirmed as such by the F-test of significance which gives a value of 1.86.

For the second relationship (B from above), the Pearson product-moment correlation is 0.36. This correlational value is almost significant at the 0.05 level. The F-test for this correlation is calculated at 3.80, slightly below the necessary table value for these data of 4.20. This correlation is significant at the 0.06 level, however.

The third correlation (C) made with data collected at the Mid-winter Conference yields a coefficient of relationship of 0.02. This is not significant; therefore we cannot reject the hypothesis of no difference.

In Table 1, below are capsulized the results of the hypothesis testing. All tests were made at the 0.05 level of significance.

Table 1.--Results of Hypothesis Testing

Hypothesis	Test used	Table value	Calculated value	Decision
1.	paired t-test (df= 28)	1.701	4.34	Reject null hypothesis
2.	paired t-test (df= 28)	1.701	3.05	Reject null hypothesis
3.	paired t-test (df= 28)	1.699	6.54	Reject null hypothesis
4.	paired t-test (df= 28)	1.701	2.93	Reject null hypothesis

		Correlation	Table value for F-test (df=1,28)	Calculated F-test value (df= 1,28)	Decision
5.	Pearson Product-Moment	0.09	4.20	0.83	No linear relationship
6.	Pearson Product-Moment	0.36	4.20	3.83	No linear relationship
7.	Pearson Product-Moment	0.36	4.20	3.85	No linear relationship
8.	Pearson Product-Moment	0.26	4.20	3.80	No linear relationship

Other descriptive data

At the close of the various activities of the Workshop, the reactions of the participants were obtained on a short questionnaire.

Activity-oriented sessions were generally ranked higher by the participants. The participant-run workshop received the highest ranking and should be included in subsequent workshops.

On Instrument B the participants were asked to indicate which of the two programs they favored more. The table below shows the responses for each of the three times that this instrument was given.

Table 2.--Elementary Science Program Preferred by Participants

	Prefer SCIS	Prefer AAAS	Both	Neither
Pretest	7	14	--	8
Posttest	12	13	4	1
Mid-winter test	15	11	3	1

There was a slight attrition of participants from the AAAS program. This is probably due in some part to the poor service which some of the participants experienced when they began to order supplies after returning to their school assignments. Those persons who were borderline at the beginning of the Workshop appear to have

moved to the SCIS program. A general feeling was that the SCIS program would be easier to install and implement into traditional schools.

On Instrument E, besides the correlations run on total scores in testing Hypothesis 8, an analysis of the pretest, perceived needs, and the posttest, satisfied needs, was completed. Those items which were perceived as the greatest needs, i.e., 75 percent or more of the responses were at the 4 and 5 rank level, include: number 1, philosophy of the programs; number 2, knowledge of the written materials; number 3, knowledge of the manipulative materials; number 10, the types of workshops which might be used in implementing the new curricula; number 12, grade levels at which new science curricula can be implemented; number 14, how one gets materials for use in teacher workshops; number 15, orientation programs; number 16, talks to PTA, School Board, teachers, etc., about the program; number 17, workshops; number 26, on-going in-service work and help; and number 28, know how to help implement new programs.

Perceived as needs by 50 percent to 74 percent of the responses at the 4 or 5 level were: number 13, where scientific principles should first be introduced; number 18, visit classes; number 19, demonstration teaching; number 22, help schools to select appropriate programs; and number 25, possibility of offering regular college courses for credit in the new programs.

At the close of the Workshop the same items were used to measure the satisfaction of perceived needs. Seventy-five percent

or more of the responses indicated that the following items were at the 4 and 5 level rank: number 1, philosophy of the programs; number 10, the types of workshops which might be used in implementing the new curricula; number 12, grade levels at which new science curricula can be implemented; number 15, orientation programs; number 16, talks to PTA, School Board, teachers, etc., about the program; number 17, workshops; number 20, consultation on problems; number 26, on-going in-service work and help; and number 28, know how to help implement new programs.

At a slightly lower percentage of response, 50 percent to 74 percent at the 4 and 5 level, were items as follows: number 2, knowledge of the written materials; number 3, knowledge of the manipulative materials; number 13, where scientific principles should first be introduced; number 14, how one gets materials for use in teacher workshops; number 19, demonstration teaching; number 22, help schools to select appropriate program; and number 27, change-agent in local schools.

By putting these pretest and posttest results into a table it is possible to get some measure of the influence of the Workshop. Table 3, below shows that those areas that were considered to be the most outstanding needs by the participants were satisfied almost fully. It is interpreted to indicate that the Workshop was most successful in reaching its intented objective of providing the participants with knowledge and philosophy of the SCIS and AAAS programs and experiences in conducting a workshop and assisting in implementation.

Table 3.--Perceived Needs and Satisfied Needs

Pretest (Perceived Needs)		Posttest (Satisfied Needs)	
High	Greatest	High	Greatest
	1		1
	2	2	
	3	3	
	10		10
	12		12
13		13	
	14	14	
	15		15
	15		15
	16		16
	17		17
18			
19		19	
	20		20
22		22	
25			
	26		26
		27	
	28		28

Some additional investigation of Instrument F was also accomplished. The results of the post-Workshop test were analyzed separately to find which of the five divisions of the Workshop, as arbitrarily set by the staff, were considered to be the most worthwhile to the participants.

As a result of this analysis, it was discovered that the three-day participant-fun workshop scored consistently high in the ranking by the participants. Those portions of the College Teacher Workshop which dealt with orientation to programs also scored high in all categories. This further supports other evidence already reported that a workshop run by the participants probably should be included in subsequent summer workshops.

The participants ranked the sessions on Change-Agent Strategies and Group Processes low in every category of measure. This is interpreted in light of other written responses to indicate that the participants felt too much time was given to Group-Process Skills. Twenty-three of the participants indicated this opinion in comments on Instrument F. Perhaps future workshops should consider giving less time for Group Process Skills, and consider eliminating Change-Agent sessions or changing the method involved in handling this aspect of the workshop program.

The Mid-winter Conference was held at Michigan State University in December, 1968. The follow-up session was aimed primarily at exchange of feedback.

One of the objectives of this study was to describe the behavior changes of the participants in their on-the-job implementation of curriculum change in activities related to the SCIS and AAAS programs. Instrument G was designed to obtain data that might indicate how the participants were performing in comparison to how they performed a year ago.

This measure was used to obtain data on the post Workshop activities of the participants and to look at changes in their behavior that could be considered as having resulted at least in part from their Workshop participation. This questionnaire was given at the commencement of the Mid-winter Conference. It was hoped that by giving the measure at this time, before interaction of the participants could begin, that individual responses would be recorded.

Some interesting results were obtained. A notable increase in the number of formal class sessions, laboratory sessions, and assignments devoted to AAAS and SCIS programs and materials was indicated. The participants indicated that almost one hundred (100) sessions or assignments were given in SCIS and AAAS this year as compared to only twelve (12) or thirteen (13) last year.

Seven of the participants indicated they had introduced AAAS or SCIS in the first weeks of school. Thirteen of the participants had given work on these programs to their classes before returning to the Mid-winter Conference at Michigan State University.

Sixty-one workshops which have included AAAS and/or SCIS in their format were reported to have been given between the Summer

Leadership Workshop and the time of the questionnaire in December.

The participants also reported that forty-two AAAS activities and thirty-six SCIS activities, all taken directly from the programs, had been included in their laboratory or regular classes. A great number of materials had also been purchased by the participants for their classes or for workshops. The amount of time that the participants are now devoting to in-service training has increased over last year. Five of the participants report that 90 percent or more of their current in-service work is in AAAS or SCIS. Eight others reported doing up to 40 percent of their in-service work in one or the other of the programs.

The effects of the Workshop appear to have diffused to colleagues of the participants. The participants report forty-four other persons on their staffs have used AAAS or SCIS this year as compared to only nine who were reported as using any of these materials a year ago.

One of the objectives of the Workshop was to create resource persons (T_3's in the implementation model). The participants reported in the mid-winter questionnaire that they had been contacted, collectively, thirty-six times for AAAS and twenty-seven times for SCIS as a direct result of the M.E.A. Camp workshop. This indicates that the participants have been established as consultants to some degree in many Michigan areas. The participants had also been involved in discussions with nine school boards and nine parent-teacher associations.

Generally, the participants do not feel that any barriers exist in the applicability and suitability of these two elementary school science programs in reference to the grade levels for which they were designed. Almost exclusively, the problems of implementation of AAAS and SCIS programs into the pre-service classes of the participants and into elementary school classrooms are those of funding.

From the participants responses on Instrument G, it appears that a definite increase in the use of the processes of science and a definite re-alignment of many pre-service programs has begun. Most of the participants, in response to the question "What major things are you doing differently than you probably would have done if you had not attended the Leadership Workshop?" answered that they are more involved in the two programs, more involved with workshops, and are drawing from their experiences at the Workshop.

The Workshop seems to have been very effective in preparing the participants as resource persons in elementary school science.

The response to the Mid-winter Conference was over-whelmingly positive.

Conclusions

The purpose of this study was to evaluate the reactions of the participants of the Leadership Workshop on Elementary School Science held at Michigan State University in the summer of 1968 so as to gain insight into the worth of the Workshop as a learning

situation and as a vehicle for change. The Leadership Workshop was designed to help fill the need for resource people who could assist school districts with the implementation of two new elementary science curricula: the AAAS Science--A Process Approach and Science Curriculum Improvement Study.

In order to accomplish this evaluation, several instruments were devised to measure the cognitive and affective results of the Workshop program. Also, an instrument was designed which would look into the behaviors of the participants many months after the Workshop in order to determine if changes occurred.

The program of the Workshop was designed to prepare the thirty participants to be consultants in the new elementary school science curricula. Also, changes in the participants' pre-service classes for teachers, stressing the philosophies currently accepted by science education leaders, was desired.

The study was based on data obtained from the college teachers and science coordinators who were the participants of the Workshop. These participants are considered a representative sample of a larger population of college science teachers and science consultants.[1]

The significant differences between pre-Workshop and post-Workshop measures as indicated by the data collected on the first four hypotheses show that the Workshop was a successful vehicle for increasing the knowledge of the participants in the topic of the Workshop and creating a positive attitude toward the AAAS and SCIS

programs. The participants also showed marked gains in knowledge of group process skills and knowledge of change-agent skills.

These gains in factual knowledge along with the significant positive change in attitudes toward the AAAS and SCIS programs are among the factors that can be positively identified as contributing to the success of the Workshop.

The attempts to show correlation among different measures were largely unsuccessful. It was anticipated that such correlations would assist future designers of workshops in their selection of activities and participants. The lack of relationships in this study does not indicate that relationships do not occur. It only indicates that, for this study, those factors chosen were not significantly related.

Implications and recommendations

The results of this study indicate that cognitive and affective changes were brought about in this Leadership Workshop. Furthermore, the results seem to indicate that the Workshop was an effective instrument for producing desired behavioral changes.

There now appears to be general acceptance of science as an integral part of the elementary school curriculum. This acceptance magnifies the need to train new teachers and retrain experienced teachers in science education in a manner which reflects current thought and practice. For this reason, it is recommended that more leadership workshops be given.

The writer recommends that evaluations be included as an integral part of the workshop, and that follow-up studies be included as part of the total evaluation.

The writer is convinced that continued support of workshops for science educators can be a meaningful and economical method for improving teacher education and elementary school science instruction.

Synopsis

A Leadership Workshop on Elementary School Science, held at Michigan State University in the summer of 1968, was designed to instruct college teachers and science consultants in Science--A Process Approach and Science Curriculum Improvement Study curricula.

This Workshop had as one of its objectives the influencing of the participants to promote these curricula and initiate change. The study evaluates the reactions of the participants to the Workshop and looks at the behavioral change of the participants after they left the Workshop.

Pre-workshop, post-workshop, and follow-up measures were made. Significant differences in knowledge of the two programs, knowledge of group-process skills, knowledge of change-agent skills, and in attitudes toward the two elementary science curricula were found.

Meaningful changes in the behaviors of the participants were noted. Increased in-service activities and an altering of pre-service courses to include more of the AAAS and SCIS philosophies and activities were among the changes reported.

The results of this study seem to indicate that workshops can be an effective instrument for producing desired behavioral changes.

References

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2. Hays, W. L. Statistics for Psychologists. New York: Holt, Rinehart, and Winston Co., 1963.